Compilation of Assumptions Used in Baseline Risk Computations for Environmental Restoration Activities

DOE Prioritization System - FY 1991 Application

Training Meeting Handout
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January 10, 1991

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UCN-87 BACK

ORGDP

ORGDP (K-25)

(need Sediment contamination of Clinch River From ORNL)

9423-DOE-2098

To: Distribution

From: Douglas T. Detman/Frank R. Morris

Date: September 15, 1989

Subject: DOE Environmental Survey - Phase III Prioritization
ORGDP Record of Assumptions
North Poplar Creek Peninsula (Reference No. 42)
(Revision #1)

Reference: DOE Environmental Survey-Phase III Prioritization
ORGDP Record of Assumptions
North Poplar Creek Peninsula (Reference No. 42)
dated April 28, 1989

1) Inventory constituents and flux rates are based on back-calculated well data from samples collected during 1987 and soil samples collected for the RFI Plan report (Reference No. 66). Strontium was added per DAR meeting 5/16/89) (Ref. No. 70).

2) The ranking unit operated from the early 1950s until 1979, and is still releasing contaminants from the soil and possible buried debris. WS-TLIFE is calculated as outlined in TG memo #12 for back-calculation of landfills.

3) The area of the ranking unit is estimated to be a rectangle with dimensions of 210 feet by 350 feet based on the area where soil samples were taken as shown in the RFI Plan. This area was used for purposes of back-calculation of contaminant inventory from well data and soil sample data.

4) The area of the plume is estimated to be a trapezoid 450 feet high, with a base of 850 feet and a width of 600 feet across the top.

5) The receptor for groundwater flow is Poplar Creek, 300 feet away.

6) Groundwater gradient is based on water levels in the creek being approximately elevation 736.5 feet and water levels measured in a well of 737.5 feet.

7) The limestone bedrock is modeled as sand for both the PSZ and SZ, and other subsurface parameters are based on subsurface testing results in Reference No. 5, and MEPAS guidance Table 2.1-1.

8) Uranium isotopic ratios are for 1.14 % enriched uranium as shown in the well data.

9) Beta radioactivity in the well data is modeled as Tc-99 at 50% of the value.

10) The ranking unit was divided into Release Unit 1 and Release Unit 2 (organics and inorganics respectively) for modeling purposes.

11) Volatilization was modeled as an additional transport pathway (TIA). The concentrations of the VOCs are similar to those used for the groundwater pathway.

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9423-DOE-2099

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From: Douglas T. Detman/Frank R. Morris

Date: September 15, 1989

Subject: DOE Environmental Survey - Phase III Prioritization
ORGDP Record of Assumptions
K-1070-C/D Classified Burial Ground (Reference No. 45)
(Revision #1)

Reference: DOE Environmental Survey - Phase III Prioritization
ORGDP Record of Assumptions
K-1070-C/D Classified Burial Ground (Reference No. 45)

1) Facilities within this ranking unit (which includes the K-1414 UST spill) have operated from 1950 until the present, and some are still releasing contaminants from the soil and buried debris. Disposal of organics started in 1977, and ceased in 1979.

2) There is a spring on the hillside below the ranking unit that allows a direct release to surface water. The spring was observed to discharge from a pipe (one foot in diameter for modeling purposes) at approximately 5 gpm during the Survey. This requires two transport scenarios: groundwater travel to Mitchell Branch, and direct surface water discharge from the spring.

3) Inventory is based on back-calculated inventory from storm drain survey data from samples collected at the spring in 1987 or well data from samples collected during 1987 (Beta activity, MEK, & xylenes).

4) The flux rates based on back-calculations are summed and divided into the 9,100 gallons of organics reported to have been disposed of in the pits to calculate the WS-TLIFE. This provides an average lifetime only because the exact quantity of each chemical is not reported in the RFI Plan.

5) The flux is divided between the two transport scenarios on the basis of estimated discharge through each scenario (25% to groundwater/75% to surface water).

6) The area of the ranking unit is a rectangle 250 feet wide and 120 feet long in the area of the pits.

7) The area of the plume used for back-calculating inventories from the spring is a rectangle from the pits to the road at the same width as the burial ground, approximately 400 feet long and 250 feet wide.

8) The receptor for groundwater flow was revised based on site comments to be Mitchell Branch, 1,700 feet away (Reference No. 14).

9) Groundwater gradient is based on water levels at Mitchell Branch being approximately elevation 751 feet and water levels measured in the wells at the ranking unit to be at approximate elevation 805 feet. The distance between the two points is 1700 feet.

10) The Upper Rome Formation PSZ bedrock is modeled as silty clay, and the SZ as a silty clay loam based on boring logs and subsurface testing results in Reference No. 5, and MEPAS guidance Table 2.1-1.

11) Beta radioactivity in the well data is modeled as Tc-99 using 50% of the value as technetium-99.

12) The leak test rate for the diesel fuel tank that leaked at K-1414 is ignored because it is only an instantaneous rate, valid only for the time of the test, and does not represent the leak rate through time.

13) The soil volume used for calculation of inventory related to the K-1414 UST spill is based on an area of contamination estimated to be approximately 100 feet wide and 120 feet long at a depth of 15 feet.

14) Diesel fuel is not modeled because there are no concentrations in soil available, and the free product floating on the water table is not identified. Several constituents are identified (and used to model the ranking unit) in the document dealing with the K-1414 UST spill (Reference No. 14).

15) Volatilization was modeled as an additional transport pathway (TIA). The concentrations of the VOCs are similar to those used for the groundwater pathway.

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Date: September 15, 1989

Subject: DOE Environmental Survey - Phase III Prioritization
ORGDP Record of Assumptions
K-1085 Old Firehouse Burn Area (Reference No. 47)
(Revision #1)

Reference: DOE Environmental Survey - Phase III Prioritization
ORGDP Record of Assumptions
K-1085 Old Firehouse Burn Area (Reference No. 47)

1) The ranking unit operated from 1945 until 1960. The WS-TLIFE is 15 years since all releases have stopped, and past releases are the only consideration (Reference No. 71).

2) Inventory constituents and flux rates are based on back-calculated well data from samples collected during 1987.

3) The ranking unit is estimated to be a square with dimensions of 50 feet on a side. The area for the ranking unit is thought (by the Survey team) to be southeast of the Oak Ridge Turnpike adjacent to the old firehouse, across the turnpike from where ORGDP had originally thought it was.

4) The area of the plume is estimated to be a rectangle 300 feet wide and 600 feet long.

5) The receptor for groundwater flow is Poplar Creek, 320 feet away.

6) Groundwater gradient is based on water levels in the creek being approximately elevation 736.5 feet and water table contour maps showing the water table at the ranking unit to be at approximate elevation 752 feet.

7) The Lower Rome Formation is modeled as silty clay (10% sand, 30% silt, and 60% clay) and other subsurface parameters are based on subsurface testing results in Reference No. 5 for the K-1407-B/C area, and MEPAS guidance Table 2.1-1.

8) Volatilization was modeled as an additional transport pathway (TIA). The concentrations of the VOCs are similar to those used for the groundwater pathway.

9) Uranium isotopic ratios are for natural uranium based on one assay from a well with U-235 = 0.72% by weight.

10) Beta radioactivity in the well data is modeled as Tc-99 for 50% of the value.

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Subject: DOE Environmental Survey - Phase III Prioritization
ORGDP Record of Assumptions
K-1407-B/C Area (Reference No. 48)
(Revision #1)

Reference: DOE Environmental Survey - Phase III Prioritization
ORGDP Record of Assumptions
K-1407-B/C Area (Reference No. 48)

1) The ranking unit, which includes several facilities (e.g., K-1413 Treatment Facility, K-1401 Degreaser, K-1503 Facility, and K-1420 Facilities), has operated from plant startup to the present, and is still releasing contaminants from the soil, ponds, and burial grounds within it.

2) There are three areas modeled in this ranking unit, and because of their different transport scenarios and inventories, these areas have been subdivided into the following:

   a) Surface Soils near K-1420 Cylinder Cleaning Facility vent release contaminants through overland flow to surface water driven by precipitation.

   b) Sediments in Mitchell Creek release contaminants directly to surface water based on fluxes developed from the NPDES discharge rate, TSS data (Reference No. 23), and sediment concentrations.

   c) The K-1407-B & C ponds, and K-1070-B Old Classified Burial Ground release contaminants from a pond to groundwater that migrate to surface water.

   Items a, b and c are set up in separated sub-ranking units because of differences in subsurface conditions, release scenarios, and source-term inventories that cannot be dealt with by the shell.

3) The areas and inventories for each of the three parts of the ranking unit have been calculated as follows:

   a) There are five soil or grass areas near K-1420 that are contaminated to a depth of six inches. The areas total approximately 101,500 square feet. The topsoil parameters are for sandy loam with bulk density rounded to 1.5 g/cc. Inventory is calculated from the average concentration of soil analyses supplied by the site at the Data Accuracy Review 5/16/89 (Reference No. 53). The start date for this scenario is 9/22/88 (sampling date).

   b) Mitchell Creek sediment is contaminated to a depth of six inches for a width of 10 feet through a length of 3,250 feet. The sediment is silt with a density of 1.48 g/cc. A one-time sampling survey (Reference No. 2) provides the basis for contaminant

concentrations in the sediments. WS-TLIFE is equal to the age of the plant plus 40 years (1989-1945) + 40 = 84 years.

c) The K-1407-B/C ponds area is composed of two triangles with a common base 900 feet long that encompasses the ponds, and the K-1070-B Old Classified Burial Ground. One triangle is 470 feet high, and the other is 740 feet high. The contaminant plume is the average of twice the area and a rectangle that is equal to the width times the distance to Poplar Creek; 1,114,500 square feet. Well data is used to back-calculate inventories and flux rates from this facility for the period 1945 through 1988 when the well data was collected. The WS-TLIFE was revised to reflect the DAR meeting comments to have the active life extend from 10 years into the future to 40 years into the future. WS-TLIFE is (1989-1945) + 40 years into the future = 84 years.

4) The groundwater gradient is based on water levels in two wells being approximately 8 feet different in elevation separated by a distance of 900 feet.

5) The receptor for groundwater flow is Poplar Creek, 1,900 feet away.

6) The Lower Rome Formation PSZ bedrock is modeled as silty clay and the SZ is modeled as sand. Other subsurface parameters are based on subsurface testing results in Reference No. 5, and MEPAS guidance Table 2.1-1.

7) Beta radioactivity in the well data is modeled as Tc-99 using 50% of the value as technetium because the plume is likely to have other Beta emitters. Analysis of the well data indicates that the apparent upgradient wells have six times the concentration as the downgradient wells.

8) Uranium isotopes modeled in the waterborne transport scenarios are based on assays from well data averaging 1.38% U-235 from the K-1407-B/C area.

9) Volatilization was modeled as an additional transport pathway (TIA). The concentrations of the VOCs are similar to those used for the groundwater pathway.

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From: Douglas T. Detman/ Frank R. Morris

Date: September 15, 1989

Subject: DOE Environmental Survey - Phase III Prioritization
ORGDP Record of Assumptions
K-1515 Water Treatment Plant Lagoon (Reference No. 68)
(Revision #1)

Reference: DOE Environmental Survey - Phase III Prioritization
ORGDP Record of Assumptions
K-1515 Water Treatment Plant Lagoon (Reference No. 68)

1) The water treatment facility has operated since the early 1940s and is still in use. It discharges wastes consisting of filter backwash and settling sludges to a lagoon measuring approximately 300 feet by 600 feet. Radionuclides settled in the sludges are the only concern, and no other constituents were modeled.

2) Inventory constituents and concentrations are based on data from samples collected as part of the CERCLA sampling program (Reference No. 67) in 1986, and the sediment data from the site-wide sediment sampling program (Reference No. 2). The inventory mass is based on the calculated volume with an assumed density of silty clay as per Table 2.1-1 of the MEPAS guidance, Reference No. 11. Moisture content of the sludge is estimated to be 40%. WS-DATE for the T2GW scenario is the sampling date - 01/01/86.

3) The receptor for groundwater flow is the Clinch River, approximately 700 feet away from the center of the pond.

4) Groundwater gradient is based on water levels in the pond being 5 ft. above the river.

5) The bedrock has not been investigated by the hydrogeologic investigation program at the site, but was modeled as silty clay loam using a value for the SZ hydraulic conductivity similar to that used for the K-901-A Holding Pond because it is located in a similar topographic setting. Other subsurface parameters are based on estimates by the site coordinator based on borings in Reference No. 5 for other ranking units, and MEPAS guidance Table 2.1-1. The infiltration rate is calculated from hydraulic conductivity and effective porosity in Table 2.1-1.

6) For the T1SW scenario, the release rate was modified to be the 1988 monthly average (51 samples) for suspended solids of 6.5 mg/l (Ref. No. 72). This was used at the daily average discharge rate of 1.44 million liters per day (Reference No. 69, page 157) to calculate a flux for

the constituents at the concentration in the sediment. The lifetime of the facility (WS-TLIFE) is based on the start date and a continued 40-year lifetime into the future: (1989 - 1940) + 40 = 89 years. Discharge is through a 5 ft. wide channel.

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9423-DOE-2103

To: Distribution

From: Douglas T. Detman/Frank R. Morris

Date: September 15, 1989

Subject: DOE Environmental Survey - Phase III Prioritization
ORGDP Record of Assumptions
K-901 Landfill (Reference No. 63)
(Revision #1)

Reference: DOE Environmental Survey - Phase III Prioritization
ORGDP Record of Assumptions
K-901 Landfill (Reference No. 63)

1) The ranking unit operated from 1969 until 1985, and is still releasing contaminants from the soil and buried debris. Since the flux rates cannot be calculated from well data as with other landfills at ORGDP, the boundary condition is set to precipitation-driven leachate.

2) Inventory and concentrations for the constituents are based on S&A soil gas analyses, and fly ash constituents from analyses of the METC fly ash (Reference No. 65).

3) The receptor for groundwater flow is the Clinch River, 1,900 feet away.

4) Groundwater gradient is based on water levels in the river being approximately elevation 736 feet and water table contour maps showing that the water table at the ranking unit is at approximate elevation 750.

5) The limestone bedrock SZ is modeled as sand, and the PSZ is modeled as a silty clay based on borings at the K-1070-A Burial Ground. Other parameters are based on subsurface testing results in Reference No. 5 for other ranking units in this formation, and MEPAS guidance Table 2.1-1.

6) Revised start date is set at 4/21/80 - sampling date (Ref. No. 65).

7) Volatilization was modeled as an additional transport pathway (TIA). The concentrations of the VOCs are similar to those used for the groundwater pathway.

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From: Douglas T. Detman/Frank R. Morris

Date: September 15, 1989

Subject: DOE Environmental Survey - Phase III Prioritization
ORGDP Record of Assumptions
K-901-A Holding Pond (Reference No. 43)
(Revision #1)

Reference: DOE Environmental Survey - Phase III Prioritization
ORGDP Record of Assumptions
K-901-A Holding Pond (Reference No. 43)

1) The ranking unit operated since the late 1950s (use 1958) until 1985 when the process was shut down. The area was impounded in 1965 by construction of a dam. A treatment unit was put into operation in 1979 to reduce the chromium to trivalent that was capable of treating 600 gpm. The area now contains hydroxide sludge. Benthic organisms are assumed not to exist.

2) Inventory constituents and concentrations are based on data from samples collected as part of the site-wide sediment sampling program (Reference No. 2) in 1986. The inventory mass is based on the discharge rate of 600 gpm at a concentration of 3,350 ppm solids from the RFI Plan (Reference No. 10). The WS-DATE for the T2GW scenario is 1986, when samples were collected.

3) The receptor for groundwater flow is the Clinch River, approximately 700 feet away from the center of the pond. The area of the ranking unit measures approximately 800 ft. by 3,000 ft.

4) Groundwater gradient is based on water levels in the pond being 5 ft. above the river, and the SZ thickness is to a depth 10 ft. below the level of the river.

5) The limestone bedrock is modeled as silty clay loam using values from the SZ hydraulic conductivity tests at the K-1232 Treatment Facility that is located in the same geologic formation. Other subsurface parameters are based on estimates by the site coordinator based on borings in Reference No. 5 for other ranking units, and MEPAS guidance Table 2.1-1. Topsoil parameters are estimated by the site coordinator to be that sludge is 40% water with a bulk density of 1.20. The infiltration rate is calculated from hydraulic conductivity and effective porosity in Table 2.1-1.

6) A direct discharge to surface water (T1SW) was added based on site comments at the DAR meeting. Fluxes are based on TSS data and sediment concentrations. WS-TLIFE = 1989 - 1958 + 40 years = 71 years.

7) Volatilization was modeled as an additional transport pathway (TIA). The concentrations of the VOCs are similar to those used for the groundwater pathway.

8) For the TIA transport scenario, a nominal water depth for ponds, lagoons, and small lakes of three feet is assumed (AG-DWAT = 0.91 meters). The surface area of the pond is 5 acres.

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9423-DOE-2105

To: Distribution

From: Douglas T. Detman/Frank R. Morris

Date: September 15, 1989

Subject: DOE Environmental Survey - Phase III Prioritization
ORGDP Record of Assumptions
Miscellaneous Landfills (Reference No. 46)
(Revision #1)

Reference: DOE Environmental Survey - Phase III Prioritization
ORGDP Record of Assumptions
Miscellaneous Landfills (Reference No. 46)

1) The ranking unit consists of an unknown number of areas where undocumented constituents were disposed of for unknown periods of time. The largest area is apparently the site north of the plant referred to as the "TVA Borrow Pit" (along with other names) by the site personnel. The pit was operated from 1979 until 1985 when it was closed and capped, but is still releasing contaminants from the buried debris. Because the constituents are thought to consist primarily of construction rubble and fly ash, an inventory similar to the K-901 Landfill was modeled. Although a cap has been installed, it is not low-permeability clay, and leachate is generated by precipitation infiltrating through it.

2) The dimensions of the landfill are approximately 400 by 1,000 feet, and it is estimated to be 20 feet deep. Inventory is proportionately calculated based on the concentrations and volume of the K-901 Landfill. Revised start date is the same as K-901 Landfill, 4/21/80 (Ref. No. 65).

3) The receptor for groundwater flow is Poplar Creek, 2,800 feet away.

4) The pore water velocity is estimated to be 0.066 foot/day based on the subsurface parameters used at another ranking unit in this formation, the K-901 Landfill, and estimated groundwater elevations of 900 feet at the ranking unit and 740 at the creek.

5) The limestone bedrock SZ is modeled as sand, and the SZ is modeled as silty clay based on borings at the K-1070-A Burial Ground. Other parameters are based on subsurface testing results in Reference No. 5 for other ranking units in this formation, and MEPAS guidance Table 2.1-1.

6) Volatilization was modeled as an additional transport pathway (TIA). The concentrations of the VOCs are similar to those used for the groundwater pathway.

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9423-DOE-2106

To: Distribution

From: Nadia Szytec-Black/Frank R. Morris

Date: September 15, 1989

Subject: DOE Environmental Survey - Phase III Prioritization
ORGDP Record of Assumptions
Integrity of USTs (Reference No. 36)
(Revision #1)

Reference: DOE Environmental Survey - Phase III Prioritization
ORGDP Record of Assumptions
Integrity of USTs (Reference No. 36)

1) Constituents modeled were taken from Table 4-9 of the Preliminary Draft Environmental Survey Report. TCE was deleted per DAR meeting 5/16/89.

2) The standard method of calculations for USTs was applied (Technical Guidance Memo #1) to calculate inventory, flux, length, width, and leach rate.

3) The receptor for groundwater flow is Poplar Creek, 1,900 feet away.

4) Subsurface parameters for the PSZ and SZ are modeled as silty clay and silty clay loam, respectively, based on subsurface testing results in Reference No. 5 for other ranking units in this formation, and MEPAS guidance Table 2.1-1.

5) Volatilization was modeled as an additional transport pathway (TIA). The concentrations of the VOCs are similar to those used for the groundwater pathway.

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From: Nadia Szytec-Black/Frank R. Morris

Date: September 15, 1989

Subject: DOE Environmental Survey - Phase III Prioritization
ORGDP Record of Assumptions
Entrance Area Buildings and Pond (Reference No. 27)
(Revision #1)

Reference: DOE Environmental Survey - Phase III Prioritization
ORGDP Record of Assumptions
Entrance Area Buildings and Pond (Reference No. 27)

RU > GW > SW

1) Entrance Area Pond (K-1007-B) is modeled to represent the ranking unit.

2) Area of the pond is 15 acres; however, WS-LENGTH and WS-WIDTH are 2,400 ft and 1,500 ft, respectively, based on MEPAS guidance.

3) Assume sediment is silt with a bulk density of 1.44 g/cm^3 and thickness of 6 inches.

4) Revised inventory for 14 constituents is modeled based on data results in RFI Plan K/HS-154 (Reference No. 54).

5) Partially saturated zone beneath the pond is modeled as silty clay and the SZ is modeled as silty clay loam. Other subsurface parameters are based on subsurface testing results in Reference No. 5 and MEPAS guidance Table 2.1-1.

6) Start date of ranking unit is set at 1988 - sampling date (Ref. 54).

7) The receptor for groundwater flow is Poplar Creek, 2,700 feet away.

RU > SW

1) Flux rate was revised and calculated using average upper bound concentrations from pond sediment data, overall average TSS from NPDES monthly average data (RFI Plan), and NPDES discharge data (Ref. No. 55).

2) Start date of ranking unit is 1950 and continues for 40 years into the future (WS-TLIFE = 79 years).

3) Receptor is Poplar Creek, which flows into the Clinch River.

RU > AIR/Surface Soil

1) Volatilization was modeled as a transport pathway. The concentrations used are similar to those for the groundwater pathways.

2) For the TIA transport scenario, a nominal water depth for ponds, lagoons, and small lakes of three feet is assumed (AG-DWAT = 0.91 meter).

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9423-DOE-2108

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From: Nadia Szytec-Black/Frank R. Morris

Date: September 15, 1989

Subject: DOE Environmental Survey - Phase III Prioritization
ORGDP Record of Assumptions
Purge Cascade Vent Areas (Reference No. 16)
(Revision #1)

Reference: DOE Environmental Survey - Phase III Prioritization
ORGDP Record of Assumptions
Purge Cascade Vent Areas (Reference No. 16)

1) Revised inventory was calculated using Purge Cascade Vent Soil analyses from K-311-1 and K-402-9 (Reference No. 53), data received from the site resulting from the DAR meeting.

2) Soil contamination is estimated to occur in the top 6 inches of soil.

3) Uranium is modeled as 95% U238 and 5% U235 per discussion with Survey team.

4) The receptor for groundwater flow and overland runoff is Poplar Creek, 1,650 feet away.

5) Subsurface parameters (PSZ and SZ) are modeled as silty clay and silty clay loam, respectively, based on subsurface testing results in Reference No. 5 for other ranking units in this formation, and MEPAS guidance Table 2.1-1.

6) Start date of ranking unit is set at 9/22/1988 - sampling date (Ref. No. 53).

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From: Nadia Szytec-Black/Frank R. Morris

Date: September 15, 1989

Subject: DOE Environmental Survey - Phase III Prioritization
ORGDP Record of Assumptions
Switchyards (Reference No. 31)
(Revision #1)

Reference: DOE Environmental Survey - Phase III Prioritization
ORGDP Record of Assumptions
Switchyards (Leaking Drums) (Reference No. 31)

1) Drums were dropped from inventory per DAR meeting 5/16/89.

2) Revised inventory is based on a 1982 reported spill of approximately 2,900 gallons of mineral oil from the K-27 Power Transformer No. 103 (Ref. No. 26 Appendix A). The Standard PCB Transformer Spill Technical Guidance Memo #3 is applied.

3) Mineral Oil from Transformer No. 103 contains an average of 62.4 ppm PCBs (general (Reference No. 26 Appendix B).

4) The receptor for groundwater flow is Poplar Creek, 2,000 feet away.

5) Subsurface parameters (PSZ and SZ) are modeled as silty clay and silty clay loam, respectively, based on subsurface testing results in Reference No. 5 for other ranking units in this formation, and MEPAS guidance Table 2.1-1.

6) Volatilization was modeled as an additional transport pathway (TIA). The concentrations of the VOCs are similar to those used for the groundwater pathway.

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9423-DOE-2110

To: Distribution

From: Nadia Szytec-Black/Frank R. Morris

Date: September 15, 1989

Subject: DOE Environmental Survey - Phase III Prioritization
ORGDP Record of Assumptions
Misc. Road Oiling and Spills (Reference No. 51)
(Revision #1)

Reference: DOE Environmental Survey - Phase III Prioritization
ORGDP Record of Assumptions
Misc. Road Oiling and Spills (Reference No. 51)

1) Length and width of Flannigans Loop Road are taken from TVA topo map Reference No. 14.

2) Assume that top 3 inches of soil is contaminated.

3) SZ thickness is estimated at 40 ft based on SC judgment and similarity in topography.

4) Subsurface characteristics for the PSZ and SZ are modeled as silty clay and silty clay loam, respectively, based on similarity to other ranking units thought to be in this formation, and subsurface testing results in Reference No. 5, and MEPAS Table 2.1-1.

5) Start date is set at 12/14/88 - sampling date (Ref. No. 58).

6) Assume that road has an 8% gradient.

7) Assume that all overland flow travels in one direction toward Poplar Creek.

8) Inventory was revised by the percent weight of oil in 11 soil samples (Reference No. 58), and the maximum concentrations of constituents analyzed in the waste oil used on the road, from data supplied after the DAR meeting 5/16/89.

9) Volatilization was modeled as an additional transport pathway (TISS). Although road oiling started in 1982 and continued until 1985 (Ref. No. 15), the case selection was modeled as a fresh spill to remain consistent with concentration/inventory values used in the water pathways, as well as to give the most conservative results.

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9423-DOE-2111

To: Distribution

From: Nadia Szytec-Black/Frank R. Morris

Date: September 15, 1989, 1989

Subject: DOE Environmental Survey - Phase III Prioritization
ORGDP Record of Assumptions
Improper Storage of PCB Equipment and Waste (Reference No. 18)
(Revision #1)

Reference: DOE Environmental Survey - Phase III Prioritization
ORGDP Record of Assumptions
Improper Storage of PCB Equipment and Waste (Reference No. 18)

1) This ranking unit models the potential release of PCBs onto surface soil; The PCB could then migrate overland to surface water.

2) Start date of the ranking unit is set at 9/1/89, based on TGM# 17.

3) Constituents modeled and their associated inventories were calculated based on data collected by the Survey team and discussions with Survey team member S.C. Caruso and revised based on DAR meeting comments by the site, and observations of inventory (Reference No. 57).

4) Length and width are based on waste site K-709.

5) Top soil characteristics are based on Nolichucky very fine sandy loam - modeled as sandy loam.

6) Volatilization was modeled as an additional pathway (TISS). The case selection for volatilization computation is handled as a fresh spill (CA-VCASE = 3) and concentrations used are similar to the overland T4SS transport scenario.

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From: Nadia Szytec-Black/Frank R. Morris

Date: September 15, 1989

Subject: DOE Environmental Survey - Phase III Prioritization
ORGDP Record of Assumptions
Surface Water (Reference No. 24)
(Revision #1)

Reference: DOE Environmental Survey - Phase III Prioritization
ORGDP Record of Assumptions
Surface Water (Reference No. 24)

Surface water data for the Clinch River is taken at mile point 14.4 - 100 yards from the ORGDP intake. 1986 USGS Water-Data Tennessee.

Discharge	4,592 CFS
Width	450 feet
Depth	3.2 feet
Velocity	3.2 ft/sec

Surface water data for the Poplar Creek uses East Fork plus Main Stem water data at mile points 13.8 and 5.2 - just north of ORGDP. 1986 USGS Water-Data Tennessee.

Discharge	203.3 CFS
Width	120 feet
Depth	7 feet
Velocity	0.26 ft/sec

When modeling receptors in the Clinch River, it is assumed the activity occurs downstream of where Poplar Creek enters the Clinch River. Therefore, the flow rate for the Clinch River is adjusted to reflect this. Clinch River flow rate for surface water receptors equals 4592 CFS + 203.3 CFS = 4795 CFS.

The Kingston intake located along the Tennessee River is also included as a surface water receptor due to occasional backflow conditions which result in water from the Clinch mixing with the Tennessee near the intake. The nearest USGS gaging station is located near the base of the Watts Bar, which has the Clinch, Emory, and Tennessee rivers flowing into it. To estimate a flow rate near the Kingston intake, the flow rates from the Clinch and Emory rivers are subtracted from the Watts Bar flow rate.

Watts Bar	27,480 CFS
Clinch River	- 4,795 (1)
Emory River	- 1,454 CFS
	21,231 (1)

The Rockwood intake was added based on the DAR meeting comments. The estimated flow rate is 27,480 CFS based on Reference No. 7, and the population of 6000 is based on Reference No. 13, p. 59.

(1) Numbers transposed erroneously. Revised after DAR meeting.

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9423-DOE-2113

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From: Nadia Szytec-Black/Frank R. Morris

Date: September 15, 1989

Subject: DOE Environmental Survey - Phase III Prioritization
ORGDP Record of Assumptions
RCW System (Reference No. 30)
(Revision #1)

Reference: DOE Environmental Survey - Phase III Prioritization
ORGDP Record of Assumptions
RCW System (Reference No. 30)

SS > GW > SW and SS > Overland > SW

The extent of contamination in surface soils is based on modeling seven cooling towers: K-892-G, K-892-H, K892-J, K-861, K-832-H, K-801-H, and K-802-H. For numerical modeling purposes, the towers are treated as point sources and their associated areas of soil contamination is based on Taylor, Mann, Dahlman, and Miller, pg. 419 (Reference No. 52).

Depth of contamination is assumed to occur in the top 6 inches of soil. Soil concentrations were based on soil samples taken at the perimeter fences of K-33-H, K-33G, and K-31 (Reference No. 49). Start date for modeling purposes is the most recent sampling date (WS-DATE = 01/01/1981 Ref. No. 49).

Surface soil is Nolichucky very fine sandy loam (Reference No. 17), and modeled as sandy loam.

The PSZ and SZ are modeled as silty clay and silty clay loam, respectively. Other subsurface parameters are based on subsurface testing results for other nearby facilities in Reference No. 5, and MEPAS guidance Table 2.1-1.

The receptor for groundwater flow is Poplar Creek, 200 feet away.

RU > GW > SW

The mean age of the basins is 19.75 years. Therefore, based on technical guidance memo #1, a 13.5% per year leak rate is applied. The mean start date is calculated as 1958.9 + 10 years (before leakage starts) = 1968.9. Shutdown date is 1985, making the active life of the ranking unit 1985-1968.9 = 16.1 years.

Volume and concentrations of chromium VI and zinc modeled are based on Table E-1 of the Working Papers, 7/29/88.

The PSZ and SZ are modeled as above.

The receptor for groundwater flow is Poplar Creek, 200 feet away.

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9423-DOE-2114

To: Distribution

From: Nadia Szytec-Black/Frank R. Morris

Date: September 15, 1989

Subject: DOE Environmental Survey - Phase III Prioritization
ORGDP Record of Assumptions
K-1232 Treatment Facility (Reference No. 34)
(Revision #1)

Reference: DOE Environmental Survey - Phase III Prioritization
ORGDP Record of Assumptions
K-1232 Treatment Facility (Reference No. 34)

Flux rates are calculated using data from K-1232 monitoring wells and Technical Guidance memo #10, Groundwater Back-Calculations using the Lotus Spreadsheet.

The area of the ranking unit is composed of two rectangles totaling 4,200 sq. ft.

The area of the plume, for back-calculation purposes, is estimated to be 108,800 sq.ft.

The back-calculated inventory is used to model both groundwater to surface water and direct discharges to surface water. In order not to overstate the annual flux rate, the back-calculated flux rate is split into 10% of the flux for discharges to groundwater and 90% of the flux for discharges to the surface water. This ratio is based on the estimated ratio of calculated groundwater flow to surface water inflow to the storm drain.

The start date of the ranking unit is set at 1972. Assume that remedial work is not completed for 40 years into the future (2029), therefore, WS-TLIFE is 2029 - 1972 = 57 years.

Constituents modeled are based on data from the K-1232 monitoring wells. The constituents are: 1,1,1-TCA, chromium III, fluoride, lead, mercury, nickel, Tc-99, tetrachloroethylene, trichloroethylene, uranium, uranium-235, uranium-238, and vinyl chloride.

Uranium isotopic ratios are for natural uranium. Beta activity in the well data is modeled as Tc-99 for 50% of the value.

The PSZ and SZ are modeled as silty clay and silty clay loam, respectively. Other subsurface parameters are based on testing results and boring logs in Reference No. 5, and MEPAS guidance Table 2.1-1.

Volatilization was modeled as an additional transport pathway (TIA). The concentrations of the VOCs are similar to those used for the groundwater pathway.

The receptor for groundwater flow is Poplar Creek, 100 feet away.

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9423-DOE-2115

To: Distribution

From: Nadia Szytec-Black/Frank R. Morris

Date: September 15, 1989

Subject: DOE Environmental Survey - Phase III Prioritization
ORGDP Record of Assumptions
Powerhouse Area (Reference No. 29)
(Revision #1)

Reference: DOE Environmental Survey - Phase III Prioritization
ORGDP Record of Assumptions
Powerhouse Area (Reference No. 29)

RU>GW>SW

1. K-700 area was modeled to represent the ranking unit.

2. Inventories are calculated using data from K-770 monitoring wells and Technical Guidance memo #10, Groundwater Back-Calculations using the Lotus Spreadsheet. Fluxes are based on inventory and WS-TLIFE.

3. The area of the ranking unit is estimated to be 800 feet by 1,200 feet.

4. The area of the plume for back-calculation purposes is estimated to be 1,335,000 square feet.

5. The start date for the ranking unit is set at 1960. The life of the unit was revised to extend 40 years into the future (2029); therefore, WS-TLIFE is 2029 - 1960 = 69 years.

6. Constituents modeled were barium, cadmium, chromium, fluoride, lead, technetium-99, tetrachloroethylene, trichloroethylene, uranium, uranium-235, and uranium-238 based on GW data.

7. Uranium isotopic ratios are for 0.98% enriched uranium.

8. Beta activity in the well data is modeled as Tc-99 for 50% of the value.

9. The majority of the ranking unit area is in the floodplain and the subsurface parameters are modeled as sandy clay loam based on boring logs in Reference No. 5, and MEPAS guidance Table 2.1-1.

10. The receptor for groundwater flow is the Clinch River, 500 feet away.

RU > OL > SW

1. Constituents modeled are based on soils monitoring data collected by the site from 1979 to 1987. Start date for modeling purposes is the most recent sampling date (WS-DATE 01/01/1987).

2. Contamination is estimated to occur within the top 6 inches of soil.

3. Estimated area of contamination is 960,000 square feet.

4. Surface water receptor is the Clinch River.

RU > AIR/SURFACE SOIL

Volatilization was modeled as an additional transport pathway (TIA). The concentrations of the VOCs are similar to those used for the groundwater pathway.

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9423-DOE-2116

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From: Nadia Szytec-Black/Frank R. Morris

Date: September 15, 1989

Subject: DOE Environmental Survey - Phase III Prioritization
ORGDP Record of Assumptions
K-1203 Sewage Treatment Plant (Reference No. 38)
(Revision #1)

Reference: DOE Environmental Survey - Phase III Prioritization
ORGDP Record of Assumptions
K-1203 Sewage Treatment Plant (Reference No. 38)

1. No data is available on sludge for the K-1203 Sewage Treatment Plant. Therefore, the amount of sludge produced and concentration of uranium and PCBs in sludge at Paducah are used. Operating capacities of Paducah and ORGDP were compared to calculate a ratio of sludge produced. This production ratio and the contaminant concentrations are then used to calculate a volume of sludge for this ranking unit.

2. The tank was installed during the 1940s. (WS-DATE = 1945).

3. When the Imhoff tank was emptied for repairs, groundwater leaked into the tank. Therefore, the RU is assumed to penetrate the saturated zone (SZ). The depth of the RU in the SZ is estimated based on the following assumptions:

   Tank depth - 40'
   PSZ thickness - 20'
   Tank stands 10' aboveground

   40' tank - (20 PSZ + 10' aboveground) = 10' in the SZ.
   The area for the RU is estimated to be 110 ft by 110 ft (Reference No. 9).

4. The PSZ is modeled as silty clay. This and other subsurface parameters are based on subsurface testing results in Reference No. 5 for other ranking units in this formation, and MEPAS guidance Table 2.1-1. Since sludge beds lie directly on the PSZ, the appropriate topsoil parameters are input as identical values.

5. The Kd values calculated by MEPAS are used versus calibrating against other Kd values on site. This is done because sludge is not a natural formation and also because the high organic content found in sludge would tend to adsorb PCBs and uranium.

6. The receptor for groundwater flow is Poplar Creek, 200 feet away.

7. Uranium isotopic ratios are for natural uranium.

8) Volatilization was modeled as an additional transport pathway (TIA). The concentrations of the VOCs are similar to those used for the groundwater pathway.

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9423-DOE-1673

To: Distribution

From: Douglas T. Detman

Date: April 28, 1989

Subject: DOE Environmental Survey - Phase III Prioritization
ORGDP Record of Assumptions
K-1070-A Contaminated Burial Ground (Reference No. 44)
(Revision #1)

1) The ranking unit operated as a landfill from 1946 until 1976, and is still releasing contaminants from the soil and buried debris. WS-TLIFE is based on TGM #12.

2) Inventory constituents and flux rates are based on back-calculated well data from samples collected during 1987 for 1,1,1-TCA; 1,1-DCE; carbon tetrachloride; TCE; trans-1,2-DCE; tetrachloroethylene; MEK; chromium; lead; and technetium-99 (using 50% of the beta activity as TC-99). Other constituent inventory is derived from inventory listed in Reference No. 3, K/HS-167, 3004 (u) Assessment. Inventory constituents for other inorganics are taken from the major items listed in Reference No. 6.

3) The area of the ranking unit is estimated to be a trapezoid with a base of 200 feet, a top width of 120 feet, and a height of 560 feet for purposes of back-calculation of contaminant inventory.

4) The area of the plume is estimated to be an ellipse with one axis 600 feet long and the other 1,050 feet long.

5) The receptor for groundwater flow is the Clinch River, 3,200 feet away.

6) The PSZ is modeled as silty clay based on boring log information, and the limestone bedrock is modeled as sand for the SZ. Other subsurface parameters are based on subsurface testing results in Reference No. 5, and MEPAS guidance Table 2.1-1.

7) Uranium isotopic ratios are based on the inventory ratios in Reference No. 3. Thorium isotope selection is based on natural thorium since no isotopic ratio is provided in the reference.

8) Volatilization was modeled as an additional transport pathway (TIA). The concentrations of the VOCs are similar to those used for the groundwater pathway.

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9423-DOE-1675

To: Distribution

From: Douglas T. Detman

Date: April 28, 1989

Subject: DOE Environmental Survey - Phase III Prioritization
ORGDP Record of Assumptions
Southern Poplar Creek Peninsula (Reference No. 41)
(Revision #1)

1) The ranking unit operated from 1970 until 1978, and is still releasing contaminants from the soil and buried debris. WS-TLIFE is calculated based on TGM #12.

2) Inventory constituents and flux rates are based on back-calculated well data from samples collected during 1987.

3) The area of the ranking unit is estimated to be a trapezoid 350 feet high with a base of 300 feet and top of 70 feet.

4) The area of the plume is estimated to be a triangle 550 feet high with a base of 350 feet.

5) The receptor for groundwater flow is Poplar Creek, 375 feet away.

6) Groundwater flow velocity is based on an estimated groundwater elevation of 765 feet at the center of the ranking unit, and an approximate elevation of 750 feet at well BRW-21. The distance is estimated to be approximately 175 feet. Saturated hydraulic conductivity is based on test results from an area in the same geologic formation listed in Reference No. 5.

7) The limestone bedrock SZ is modeled as sand, and the PSZ is modeled as silty clay. Other subsurface parameters are based on subsurface testing results in Reference No. 5, and MEPAS guidance Table 2.1-1.

8) Beta radioactivity in the well data is modeled as Tc-99 using 50% of the value as technetium.

9) Volatilization was modeled as an additional transport pathway (TIA). The concentrations of the VOCs are similar to those used for the groundwater pathway.

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9423-DOE-1677

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From: Douglas T. Detman

Date: April 28, 1989

Subject: DOE Environmental Survey - Phase III Prioritization
ORGDP Record of Assumptions
K-1099 Blair Road Quarry (Reference No. 40)
(Revision #1)

1) The ranking unit operated since plant startup until 1970. WS-TLIFE equals 40 years + (1970 - 1945); 65 years.

2) Inventory constituents and flux rates are based on back-calculated well data from samples collected during 1987.

3) The area of the ranking unit is estimated to be a circle with a radius of 100 feet, roughly the area of the quarry floor.

4) The area of the plume is estimated to be a trapezoid 550 feet high, with a base of 400 feet and a width of 200 feet across the top.

5) The receptor for groundwater flow is Poplar Creek, 400 feet away.

6) Groundwater gradient is based on water levels in the creek and monitoring well BRW-1 to be 1 foot/400 feet.

7) The limestone bedrock is modeled as sand, and other subsurface parameters are based on SC judgment, subsurface testing results in Reference No. 5, and MEPAS guidance Table 2.1-1.

8) Uranium isotopic ratios are 1.255% for enriched uranium, based on well data assays (Ref. No. 6).

9) In order to be conservative, all of the Beta radioactivity in the well data is modeled as Tc-99 for this ranking unit only.

10) Volatilization was modeled as an additional transport pathway (TIA). The concentrations of the VOCs are similar to those used for the groundwater pathway.

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To: Distribution

From: Douglas T. Detman

Date: April 28, 1989

Subject: DOE Environmental Survey - Phase III Prioritization
ORGDP Record of Assumptions
Subsurface Physical Properties (Reference No. 62)
(Revision #1)

1) Subsurface physical properties are derived from field testing and boring data developed by ORGDP as part of the site investigations dealing with DOE Order 5480.14. The principal source is Kuhlmeier, P. D. et al., 1986. Hydrogeology of the Oak Ridge Gaseous Diffusion Plant Site, K/SUB/85- 22224/1 (Reference No. 5).

2) Since many of the ranking units do not have extensive subsurface data, a general assumption is made that similar geologic settings at different ranking units will have similar properties.

3) The principal geologic formations are limestones and shales that are fractured rock media, and thus are not directly applicable to the porous media (sand, silt, and clay) that the MEPAS model has been written to simulate. Because of this difference, the selections made for the subsurface constituents do not reflect rock names, but the closest choice available with similar flow velocities.

4) Table 2.1-1 from MEPAS (Reference No. 11) is used for certain parameters such as Porosity, Bulk Density, and Field Capacity, based on the soil name selected for the rock unit being modeled.

5) For ranking units that have subsurface boring information, the thickness of the Partially Saturated Zone (PSZ) and Saturated Zone (SZ) is based primarily on the depth to water, and not always the top of rock as shown on the boring logs in Reference No. 5. The thickness of the SZ is dependent on the elevation of the water table and the elevation of the Clinch River or Poplar Creek. It is assumed that the majority of flow in the rock is within the upper few feet of the formation, thus the full thickness of the formations is not used as the thickness of the SZ.

6) Calculations for the saturated hydraulic conductivity are the basis of calculating the infiltration rate and pore water velocity. These values are based on Table 2: Results of Permeability Tests, in Reference No. 5. The balance of input for calculation of pore water velocity is from measurements in the wells shown on the individual figures in Reference No. 5, and distance measurements on the site maps (References No. 8 & 14).

7) Ranking units that have back-calculated source-term inventories based on monitoring well sample analyses have concentrations and constituents based on the Survey Report listings in the findings, and data provided to the Survey team during the on-site Survey. Some of the data is incomplete, and only three of the four quarters had been collected at the time of the Survey. Since the data is representative of only a portion of the groundwater contamination known to exist at the sites, the back-calculated inventory is considered to be applicable for general modeling purposes only. The lack of an extensive monitoring network at each of the

sites or ranking units prevents a complete plume definition, background concentration definition, and thus total contaminant quantity.

Distribution:
R. Aiken (DOE)
M. Gilbertson (DOE)
S. Barisas (DOE)
D. Misenhimer (NUS)
M. Francis (NUS)
N. Szytec-Black (NUS)
A. Toblin (NUS)
ORGDP File 21.9
Chron
DOE 9423 Project File 7.0

cc:
R. Waller
P. Alexandro
T. Brandt

9423-DOE-1707

To: Distribution

From: Nadia Szytec-Black

Date: April 28, 1989

Subject: DOE Environmental Survey - Phase III Prioritization
ORGDP Record of Assumptions
Surface Water Recreation (Reference No. 22)
(Revision #1)

Population numbers for surface water recreation are estimated using a 10-mile boundary along surface water bodies and overlaying it with a population gridwheel (from the Environmental Surveillance of the Oak Ridge Reservation and Surrounding Environs during 1985).

The values are:

Clinch River	182,259 people for fishing, boating, swimming, and shoreline activities

Distribution:
R. Aiken (DOE)
M. Gilbertson (DOE)
S. Barisas (DOE)
D. Misenhimer (NUS)
M. Francis (NUS)
D. Detman (NUS)
A. Toblin (NUS)
ORGDP File 21.9
Chron
DOE 9423 Project File 7.0

cc: R. Waller
P. Alexandro
T. Brandt

9423-DOE-1708

To: Distribution

From: Nadia Szytec-Black

Date: April 28, 1989

Subject: DOE Environmental Survey - Phase III Prioritization
ORGDP Record of Assumptions
Surface Water Agricultural Production (Reference No. 21)
(Revision #1)

To collect data on agricultural production using surface water for 50 river miles downstream of the Oak Ridge Reservation, the following agricultural extension offices were contacted: Knox, Loudon, Meigs, Rhea, and Roane. Anderson County was not contacted because the only land adjacent to the Clinch River that would be considered a possible receptor is within the boundaries of the Oak Ridge Reservation. Based on telephone conversations with these offices, the following agricultural rates are calculated for Y-12, X-10 and ORGDP.

AGRICULTURAL PRODUCTION

County	Vegetable	Crops	Livestock-Cattle
Anderson	None	None	None
Knox	None	None	499 head
Loudon	None	None	None
Meigs	None	300 acres	None
Rhea	10 acres	90 acres	None
Roane	None	None	300 head

CROP PRODUCTION

Meigs County
grain for food 0.26 kg/m^2 + x 4047 m^2/acre x 300 acres = 315,666 kg

Rhea County
grain for food 0.24 kg/m^2 + x 4047 m^2/acre x 90 acres = 87,415 kg
leafy vegetables 3.46 kg/m^2 + x 4047 m^2/acre x 10 acres = 140,026 kg

Total Production using Surface Water
grain crops 403,081 kg/year
leafy vegetables 140,026 kg/year

MEAT/MILK PRODUCTION

Knox County

2,386 Total Milk Cows*		14,810 Total Beef Cows*
(2,386/17,196) (499 head)	=	70 Milk Cows
(14,810/17,196) (499 head)	=	429 Beef Cows

Roane County

1,591 Total Milk Cows*		6,727 Total Beef Cows*
(1,591/8318) (300 head)	=	57 Milk Cows
(6,727) (8318) (300 head)	=	243 Beef Cows

Milk Production

(70 + 57) Milk Cows x 4083 kg/yr/cow** = 518,541 kg/yr

Meat Production

(429 + 243) Beef Cows x 50.75 kg/head** = 34,106 kg/yr

* Shore, Baes, Sharp, 1982.
** MEPAS Guidelines, Section 4.1.

FINFISH PRODUCTION

Estimated annual finfish production is based on the average flow rate of the Clinch River at ORGDP, which is >1000 CFS. Therefore, based on MEPAS guidelines (Sec. 4.2) EW-PRODFF = 10,000 kg/yr.

Distribution:
R. Aiken (DOE)
M. Gilbertson (DOE)
S. Barisas (DOE)
D. Misenhimer (NUS)
M. Francis (NUS)
D. Detman (NUS)
A. Toblin (NUS)
ORGDP File 21.9
Chron
DOE 9423 Project File 7.0

cc:
R. Waller
P. Alexandro
T. Brandt